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SCOPOLAMINE :

Its Value in Ophthalmic Practice.

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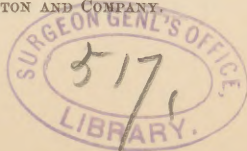
By W. HARVEY SMITH, A. M., M. D., C. M.,
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THE attention of the medical profession of this country has recently been drawn by Dr. Haskett Derby, of Boston, and Dr. Pooley, of New York, to the value of scopolamine as a mydriatic. The use of this drug in America seems to have been very limited, and comparatively little information can be obtained regarding its exact properties and action and its worth compared with the standard mydriatics, atropine and homatropine.

Scopolamine is obtained from the roots of *Scopolia atropoides*, and is isomeric with atropine, hyoscine, duboisine, daturine, and the other members of the tropane series. By some authorities it is considered to be identical, not only in formula but in physiological action, with hyoscine, but on this point conclusive proof is lacking.

It is used in aqueous solutions, which undergo decomposition much less readily than similar solutions of atropine and homatropine.

Koeber's experiments have shown that "this substance is opposed in general physiological action to atropine; it



does not stimulate the cerebral cortex like atropine, but paralyzes it."

According to Dr. Rahlmann (*Münch. med. Wochenschr.*) "scopolamine excels as a mydriatic and antiphlogistic all other tropeines in use. It is similar to hyoscyne in strength of mydriatic action, without sharing its disadvantages; it has no untoward effects, does not disturb the appetite, nor does it cause, in normal doses, dryness of the throat, nervous restlessness, reddening of the face, or frequent pulse, as in the case of atropine.

"The antiphlogistic and anodyne effect of scopolamine is not second to that of atropine, a steady diminution of the hypopion being observed in five cases after its application. It does not affect intraocular pressure, and will therefore, in contrast to atropine, be readily borne where there is a pathological increase of the same.

"Scopolamine hydrobromate is used in one fifth and one tenth per cent. solutions, which are said to correspond with one half and one per cent. atropine solutions."

In February last Dr. D. B. St. John Roosa introduced the use of scopolamine into the Manhattan Eye and Ear Hospital in the treatment of his clinic and indoor patients, and since that time it has had a fairly general trial throughout the hospital, and its value has been pretty accurately determined in pathological and ametropic conditions, particularly the latter. Careful observations have been made in about twenty-five refraction cases, with the view of ascertaining the rapidity and thoroughness with which the accommodation can be paralyzed and the pupil dilated by scopolamine, the best method of using the drug, and the minimum strength of solution which will produce satisfactory results, physiological and toxic effects, and the duration of mydriasis and cycloplegia.

In pathological cases reliable conclusions as to the

beneficial or deleterious effects of scopolamine have been difficult to arrive at, owing to the fact that it is no easy matter to decide whether an abatement or an increase in the severity of an ocular disease (where only a limited number of cases can be utilized for experimentation) is due to the use of a certain drug.

The strength of the solutions employed in both pathological and refraction cases was usually one fifth or less frequently one tenth per cent., one or two drops being instilled into each eye until four or five instillations had been made. Maximum dilatation of the pupils was produced in all refraction cases in from ten to twenty-five minutes.

The amplitude of accommodation, as indicated by the number and distance at which Jaeger test type could be read by the patient, showed a decrease directly proportionate to the rapidity with which the pupil dilated; at the end of twenty or thirty minutes such spherical glasses were placed before the patient's eyes as would bring the near point to about twelve inches, and in nearly all the cases examined, where the perceptive functions of the eye were not at fault, the distance on each side of the point of focus at which Jaeger No. 1 could be read was from one to two inches—in other words, about the same range that we have found to be present in aphakia, and in eyes that have been fully atropinized. In the majority of patients the effect of scopolamine on the heart was manifested within from five to ten minutes by a gradual diminution in the rate of the pulse, which was lessened in three cases as much as thirty to the minute, and was often characterized by more or less softness and compressibility. In a few cases the pulse rate was increased or became irregular in rhythm. The distant vision, which was recorded every five minutes, showed the usual diminution, the amount depending upon the variety of ametropia, the strength of

the solution, and the frequency with which it was instilled. In the refraction cases toxic symptoms were induced eight times, mostly at first, as no attempt was made, by everting the puncta or pressing upon the nasal ducts, to prevent the solution from running into the nose; later on these precautions were taken, thus accounting for the infrequency of poisonous symptoms in the last fifteen cases. These symptoms resemble very closely those produced by atropine, dryness of the throat being usually the first indication of toxic effect; this came on in from fifteen minutes to an hour and lasted from four to thirty-six hours. Following this was observed marked muscular weakness, with unsteady, staggering gait and great dizziness; these symptoms manifested themselves within an hour, the duration being from twelve to twenty-four hours. Loss of appetite, with considerable nausea, lasting a day, was observed in two cases. Some patients became very restless, and others, the majority, exhibited the opposite condition; in three cases great drowsiness came on within an hour; in one case the primary effect of the drug was exhilaration, followed in an hour by depression, the patient becoming very sleepy and heavy. The taste of the drug was often complained of and was described as being "nasty and bitter." Flushing of the face was observed only twice.

In cases of iritis, kerato-iritis, hypopion, episcleritis, etc., where scopolamine was used, its effects were very satisfactory, but it seemed to possess no advantage over atropine. In a patient who had always been very susceptible to the influence of atropine the instillation of one drop of the one fifth per cent. solution of scopolamine hydrobromate was sufficient to produce considerable flushing of the face. We have been unable to make any observation which would support the claims made by Rahlmann that scopolamine will not increase tension. For purposes of examination or

operation the drug has been found specially useful, owing to the rapidity of mydriatic action, one or two drops of the one fifth or one tenth per cent. solution being sufficient to fully dilated the pupil in from ten to twenty-five minutes. The average duration of cycloplegic and mydriatic effect we have found to be from five to eight days. Comparatively few tests with the weaker solutions have been made, but the results so far obtained from the use of a one tenth per cent. solution have been satisfactory. In the case of a little girl with spasm of accommodation, seven instillations in sixty hours completely paralyzed the ciliary muscle, the effect lasting for six days.

In all the refraction cases examined the results have been practically the same, so far as rapidity and thoroughness of action and duration of effect are concerned. A detailed account of two or three cases will therefore be sufficient to indicate the advantages or disadvantages which, in our experience, the drug possesses.

CASE I.—Mrs. G., aged thirty-five years, examined February 25, 1894. Complains of inability to do near work for any length of time, has headache more or less constantly, and eyes have of late felt sore and tired; no external ocular disease.

V., O. D. $\frac{2.0}{3.0}$; $\frac{2.0}{3.0}$ w. +1.0 D. s. \bigcirc +1 D. cyl. ax. 90° .

V., O. S. $\frac{2.0}{3.0}$; $\frac{2.0}{3.0}$ w. +1.0 D. s. \bigcirc +0.50 D. cyl. ax. 90° .

Javal, O. D. 1.5 D. ax. 90° , 180° W. R. O. S. 1 D. ax. 90° , 180° W. R.

Jaeger No. 2 at six inches.

Ophthalmoscope, O. D. $\frac{+5}{+4}$. O. S. $\frac{+4}{+3}$.

Fundi normal, refracting media clear, some spasm of ciliary muscle. Patient was tested three weeks ago under atropine, result being—

V., O. D. $\frac{2.0}{3.0}$; $\frac{2.0}{3.0}$ w. +3 D. s. \bigcirc +1.5 D. cyl. ax. 90° .

V., O. S. $\frac{2.0}{3.0}$; $\frac{2.0}{3.0}$ w. +3.5 D. s. \bigcirc +0.75 D. cyl. ax. 90° .

Sol. scopolamine hydrobromate one fifth per cent. instilled, detailed in the following table.

CASE I.

Time.	Instillation.	Pupils.	Accommodation.	Vision.
0 min.	Gtt. ij in each eye.	O. D. 4.0 mm.,	Jaeger No. 2 at 6 inches.	O. D. $\frac{20}{30}$, $\frac{20}{40}$, $\frac{20}{60}$, $\frac{20}{100}$
5 "	" "	O. D. 4.0 mm.,	" " 4 at 8 "	O. D. $\frac{20}{30}$, $\frac{20}{40}$, $\frac{20}{60}$, $\frac{20}{100}$
10 "	" "	O. D. 5.5 mm.,	" " 10 at 12 "	O. D. $\frac{20}{30}$, $\frac{20}{40}$, $\frac{20}{60}$, $\frac{20}{100}$
15 "	" "	O. D. 6.5 mm.,	" " 13 at 12 "	O. D. $\frac{20}{30}$, $\frac{20}{40}$, $\frac{20}{60}$, $\frac{20}{100}$
20 "	" "	O. D. 7.5 mm.,	O. D. $\frac{20}{30}$, $\frac{20}{40}$, $\frac{20}{60}$, $\frac{20}{100}$

CASE II.

Time.	Instillation.	Pupils.	Accommodation.	Vision.
0 min.	Gtt. ij in each eye.	O. D. 4.5 mm.,	Jaeger No. 1 at 6 inches to 13 inches.	O. D. $\frac{20}{30}$, $\frac{20}{40}$, $\frac{20}{60}$, $\frac{20}{100}$
5 "	" "	O. D. 5.5 mm.,	" " 1 at 8 " to 15 "	O. D. $\frac{20}{30}$, $\frac{20}{40}$, $\frac{20}{60}$, $\frac{20}{100}$
10 "	" "	O. D. 5.5 mm.,	" " 1 at 15 " to 18 "	O. D. $\frac{20}{30}$, $\frac{20}{40}$, $\frac{20}{60}$, $\frac{20}{100}$
15 "	" "	O. D. 6.5 mm.,	" " 13 at 20 "	O. D. $\frac{20}{30}$, $\frac{20}{40}$, $\frac{20}{60}$, $\frac{20}{100}$
20 "	" "	O. D. 7.0 mm.,	" " 13 at 20 "	O. D. $\frac{20}{30}$, $\frac{20}{40}$, $\frac{20}{60}$, $\frac{20}{100}$
25 "	O. D. 7.0 mm.,	" " 14 at 20 "	O. D. $\frac{20}{30}$, $\frac{20}{40}$, $\frac{20}{60}$, $\frac{20}{100}$

Patient complains of a little dizziness w. +5D., reads Jaeger No. 2 at eleven to fourteen inches.

25 min.—Ophthalmoscope +4 D., each spasmodic action of ciliary muscle has ceased.

Retinoscopy, O. D. $\begin{array}{c} +4 \\ | \\ \hline \end{array}$ +5. O. S. $\begin{array}{c} +3.5 \\ | \\ \hline \end{array}$ +4.

30 min.—V., O. D. $\frac{2.0}{200}$; $\frac{2.0}{200}$ w. +3.5 D. s. \bigcirc +1 D. cyl. ax. 90°.

V., O. S. $\frac{2.0}{200}$; $\frac{2.0}{200}$ w. +3.5 D. s. \bigcirc +0.75 D. cyl. ax. 90°.

Reads Jaeger No. 1 from nine to eleven inches w. +4 D. added to above correction in each eye.

35 min.—Patient complains of great dizziness, muscular weakness, dryness of the throat, and headache; is unable to walk straight, and appears to be very restless.

February 21st.—Patient returned to hospital to-day stating that above-mentioned symptoms lasted for twelve hours, and that, in addition, she had experienced considerable nausea and impairment of appetite.

22d.—With same correction as on February 20th, range for Jaeger No. 1 is nine to eleven inches; pupils widely dilated. Toxic symptoms have subsided and patient feels perfectly well.

28th.—Pupils four millimetres each.

O. D. w. +3 D. s. \bigcirc +1 D. cyl. ax. 90°.

O. S. w. +3.5 D. s. \bigcirc +0.50 D. cyl. ax. 90°.

Patient reads Jaeger No. 1 at ten inches without correction. Distant V., O. D. = $\frac{2.0}{50}$, O. S. $\frac{2.0}{40}$; with correction = $\frac{2.0}{20}$ both.

When last seen patient was wearing the above correction constantly, and she states that the glasses have completely relieved her asthenopic symptoms.

This case demonstrates how readily toxic effects can be produced, and would disprove the statements made by the advocates of the use of scopolamine that it does not cause nervous restlessness, dryness of the throat, or disturbance of appetite.

CASE II.—John M., aged ten years, has ten degrees of alternating convergent strabismus of two years' duration.

V., O. D. $\frac{2.0}{40}$; $\frac{2.0}{20}$ w. +2 D. s. \bigcirc +0.50 D. cyl. ax. 90°.

V., O. S. $\frac{2.0}{20}$; $\frac{2.0}{20}$ w. +3.5 D. s. \bigcirc +0.50 D. cyl. ax. 90°.

Jaeger No. 1, six to thirteen inches.

Javal, O. D. and O. S. 1 D. ax. 90°, 180° W. R.

Ophthalmoscope, O. D. + 3 D.; O. S. + 6 D. •More or less spasm of ciliary muscle renders ophthalmoscopic estimation of refraction inaccurate.

Scopolamine used as in former case, with the difference that the nasal ducts were compressed during and for a few minutes after each instillation of the drug.

With +10 D. before each eye Jaeger No. 1 is read from six and a half to eight inches.

Ophthalmoscope, +8 D. each. No blurring.

Retinoscopy, O. D. and O. S. $\frac{+7}{+}$ +7.

V., O. D. $\frac{20}{200}$; $\frac{20}{20}$ w. +7 D. s.

V., O. S. $\frac{20}{200}$; $\frac{20}{20}$ w. +7 D. s.

Accepts no cylinder. Visual axes parallel. No toxic symptoms induced. The subsequent behavior of the ciliary muscle and iris was not determined, as patient could not return for examination.

This case illustrates the rapidity and thoroughness with which paralysis of the accommodation can be produced by scopolamine, and shows that the danger of toxic effect is reduced to a minimum by taking the precautions mentioned above.

CASE III shows in a typical manner the effect of the drug upon the pulse, which before the first instillation was 92; five minutes after the first instillation was 87; five minutes after the second, 80; five minutes after the third, 73; five minutes after the fourth, 69.

The pulse was regular throughout, but became soft and compressible within ten minutes after the drug had been used.

Had it been possible to compare the action of other mydriatics on patients upon whom the scopolamine had been tried, the deductions might have been more absolutely reliable; still, I think the observations so far made justify us in coming to the following conclusions:

1. That the toxic effect of scopolamine used in one

tenth and one fifth per cent. solutions are easily produced, but can readily be avoided if the lids be everted or the nasal ducts compressed at the time of instillation.

2. That in diseased conditions of the eye scopolamine is quite as useful a drug as atropine.

3. That in refraction work complete and thorough paralysis of accommodation with the maximum of mydriasis can be produced in from twenty minutes to half an hour, where the drug is used *coup sur coup*, and that the duration of its effect is from five to eight days.

4. That its greatest value lies in the rapidity of its action, which renders it specially useful for purposes of examination in refraction cases and in diseased conditions of the interior of the eye.

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FRANK P. FOSTER, M.D.

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